

## What is Claimed:

1                   1.     A scrambling method for scrambling UWB (ultra wideband) data,  
2                   the method comprising the steps of:

3                   shifting a first bit string a first number of bits;

4                   shifting a second bit string a second number of bits;

5                   combining the first and second shifted bit strings;

6                   generating scrambler control bits from the combined first and second  
7 shifted bit strings; and

8                   scrambling at least a portion of the UWB data responsive to the  
9 generated scrambler control bits.

1                   2.     The method of claim 1, further including where the first bit string  
2 and the second bit string are randomly initialized.

1                   3.     The method of claim 2, wherein the first bit string and second bit  
2 strings are randomly initialized using a pseudo random sequence.

1                   4.     The method of claim 2, wherein the first bit string and second bit  
2 strings are randomly initialized using a random sequence.

1                   5.     The method of claim 1, wherein the scrambling method for  
2 scrambling UWB data is applied to each frame.

1                   6.     The method of claim 1, wherein the UWB data includes payload  
2 and non-payload data and the scrambling step scrambles the payload data.

1                   7.     The method of claim 6 wherein the method further comprises the  
2 step of:

3                   selectively applying random frame reversion to the non-payload data.

1                   8.     The method of claim 7 wherein the step of selectively applying  
2 random frame reversion to the non-payload data includes the steps of:

3                   generating a pseudo random sequence with an evenly distributed  
4 function;

5                   selectively inverting a data sequence responsive to the pseudo random  
6 data sequence.

1                   9.     A scrambling method for scrambling ultra wideband (UWB) data  
2 having payload data and non-payload data, the method comprising the steps of:

3 scrambling the payload data using a pseudo random sequence configured  
4 for initialization using a seed set with substantially uncorrelated seed values; and  
5 selectively applying random frame reversion to the non-payload data.

1 10. The method of claim 9 wherein the step of selectively applying  
2 random frame reversion to the non-payload data includes the steps of:

3 generating a random sequence with an evenly distributed function;  
4 selectively inverting a data sequence responsive to the random data  
5 sequence.

1 11. A scrambler for scrambling UWB data, the scrambler comprising:  
2 a first shift register to shift a first bit string a first number of bits;  
3 a second shift register to shift a second bit string a second number of  
4 bits;  
5 a combining circuit to combine the first and second shifted bit strings;  
6 a third shift register to load the combined first and second shifted bit  
7 strings; and

8 a control circuit to generate scrambler control bits from the combined  
9 first and second shifted bit strings for scrambling at least a portion of the UWB data.

1 12. The scrambler of claim 11, further including a polynomial  
2 generator which produces a pseudo random sequence to initialize the first bit string and  
3 the second bit string.

1 13. The scrambler of claim 12, wherein the random sequence  
2 produced by the polynomial generator is greater than or equal to 15 bits.

1 14. The scrambler of claim 11, wherein the first shift register and the  
2 second shift registers are initialized responsive to a new frame.

1 15. The scrambler of claim 14, wherein each frame of the UWB data  
2 includes payload and non-payload data and the scrambler further comprises:

3 a selective random frame reversion circuit for selectively inverting at  
4 least the non-payload data of each scrambled frame.

1 16. The scrambler of claim 15 wherein the selective random frame  
2 reversion circuit comprises:

3                   a random sequence generator to generate a pseudo random data  
4                   sequence with an evenly distributed function; and  
5                   an inverter to selectively invert a data sequence responsive to the pseudo  
6                   random data sequence.

1                   17. A scrambler system for data whitening to reduce the PSD (power  
2                   spectral density) of (ultra wide-band) UWB signals having payload data and non-  
3                   payload data, the scrambler system comprising:

4                   a scrambler configured to scramble the payload data, the scrambler  
5                   comprising a linear feedback shift register configured for initialization using a seed set  
6                   with substantially uncorrelated seed values; and

7                   a selective random frame reversion circuit configured to selectively invert  
8                   the non-payload data.

1                   18. The scrambler of claim 17, wherein the seed set includes at least  
2                   4 seed values and wherein the seed value within the seed set has at least 16 bits.

1                   19. The scrambler of claim 17 wherein the selective random frame  
2                   reversion circuit includes:

3                   a random sequence generator to generate a pseudo random sequence  
4                   with an evenly distributed function; and

5                   an inverter to invert a data sequence responsive to the random data  
6                   sequence.

1                   20. A computer readable carrier, including software that is configured  
2                   to control a computer to implement a scrambling method for scrambling UWB data, the  
3                   method including the steps of

4                   shifting a first bit string a first number of bits;

5                   shifting a second bit string a second number of bits;

6                   combining the first and second shifted bit strings;

7                   generating scrambler control bits from the combined first and second  
8                   shifted bit strings; and

9                   scrambling at least a portion of the UWB data responsive to the  
10                  generated scrambler control bits.

1                   21.    A computer readable carrier including software that is configured  
2    to control a computer to implement a scrambling method for scrambling UWB data  
3    having payload data and non-payload data, the method comprising the steps of:  
4                   scrambling the payload data using a pseudo random sequence configured  
5    for initialization using a seed set with substantially uncorrelated seed values; and  
6                   selectively applying random frame reversion to the non-payload data,  
7    random frame reversion including the steps of:  
8                   generating a random sequence with an evenly distributed function;  
9                   selectively inverting a data sequence responsive to the random data  
10   sequence; and  
11                  transmitting the selectively inverted data sequence.